NEW YORK STATE DEPARTMENT OF TRANSPORTATION MATERIALS BUREAU ALBANY, NY 12232 MATERIALS METHOD	MATERIALS METHOD - NY 5.12 ISSUE DATE - MARCH, 1981

PLANT INSPECTION PROCEDURES FOR DRUM MIX ASPHALT CONCRETE PLANTS

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I. SCOPE

This Method describes the procedure for determining the quality of asphalt concrete produced in a drum mixer. It shall be used in conjunction with other sections of Materials Method 5, Plant Inspection of Bituminous Concrete.

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III. GENERAL METHOD

All provisions of Materials Method 5, Plant Inspection of Bituminous Concrete, shall apply except those portions that pertain solely to batch type plants or are in conflict with this Materials Method.

Drum mix plants differ from batch plants and it is necessary to treat their inspection procedures separately. The drum mix plant proportions uniformly graded aggregates in the proper amounts by fully controllable cold feeders. The total weight of the continuous flow of aggregates from the feeders to the mixer is measured by a weighing belt scale(s). Asphalt cement is pumped continuously into the mixer in the amount required for the proper percentage of bitumen in the mixture. This process goes on simultaneously and continuously until the required amount of mix is produced. (See Figure #1.) The rate at which the mix is produced can be either increased or decreased within the production range of the plant as the project demands.

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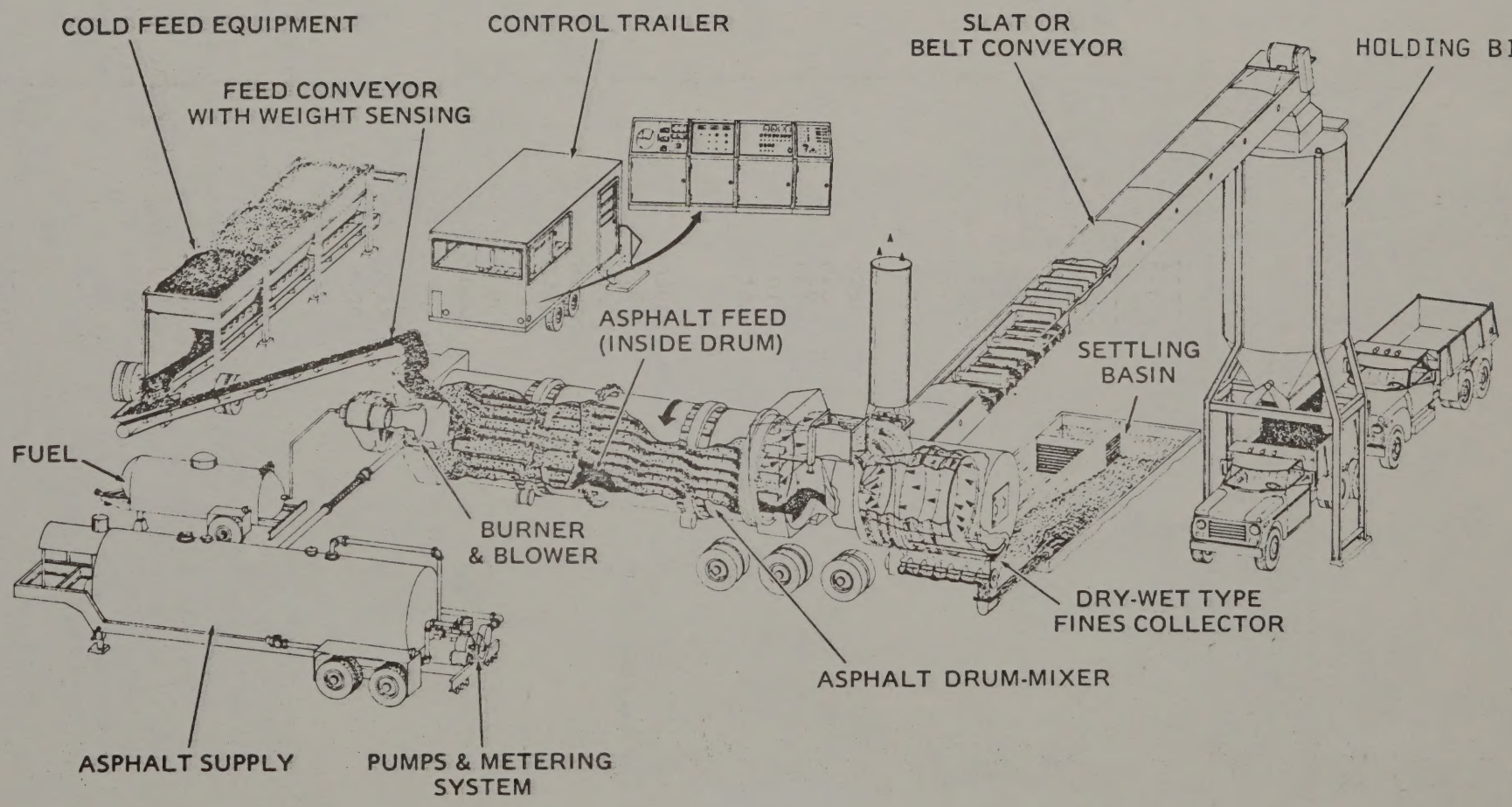

Components of Typical Drum Mix Asphalt Plant

Figure 1

Drum mix plants produce bituminous concrete mixtures that reflect whatever is input into the system. The aggregate from the stockpile is proportioned without rescreening. Therefore, improperly graded or proportioned material will be reflected in the mixture.

Drum mix plants can produce large quantities of mixture in a short time. For this reason, production errors can quickly produce considerable amounts of out of specification material. An adequate inspection and testing program can assure the Department that specification material is being produced. This program for Production Inspection is divided into three phases:

1. Plant Operation. The steps the Inspector must take prior to and during production to see that the physical plant is performing properly and to see that the necessary information and materials are available for proportioning, mixing and conveyance through the system for delivery to the projects.

2. Sampling and Testing. The steps the Inspector must take to assure that the materials and equipment used for production of Department mixes meet specifications.

3. Acceptable Quantity. The documentation needed to verify that the quantity of mix produced is acceptable and dispatched to the project.

IV. PRODUCTION INSPECTION

The production is inspected by (1) monitoring the plant operation, (2) testing the aggregate for uniformity at the stockpile, (3) testing the composite gradation at the feeds, and (4) determining the composite aggregate moisture. The mixture is checked for (1) asphalt content, (2) moisture content, and (3) temperature.

A. PLANT OPERATION

The plant operation inspection consists of taking the necessary steps to insure that production of the bituminous concrete mixtures are within Department specifications. The following procedures must be done on a daily basis:

1. Prior to Production:

   a. Check to see that the aggregate cold feed bins are properly identified and that the proper size aggregates are in the correct bin.

   b. Check the cold feed gate settings to see that they match the mix to be produced at the anticipated production rate. The allowable gate settings are listed in the automation approval letter.

c. Check to see that the belt scale is warmed up for at least 15 minutes prior to starting production. Check to see that the scale reads zero with no load and that the span setting has not been changed from what was determined during the last belt scale test.

d. Check the temperature of the bituminous material in plant feed line. The material must be within ± 25°F of the temperature at which the meter was calibrated.

e. Check to see that the feeder belt settings for aggregate and mineral filler (if added separately) are preset into the automation system for proper proportioning. This shall be done in conjunction with the inspection of the aggregate feeder gate settings. It may be necessary for the plant to be running to check this.

f. Check to see that the proper bitumen percentage is input into the automation system. This includes seeing that the correct asphalt specific gravity (or pounds per gallon) is also input.

g. Check to see that the composite aggregate moisture content is correctly preset.

h. Check to see that all aggregate and bitumen weight indicators are reset to zero and functioning properly. These should be reset to zero daily or whenever a change in mix type is made during the day.

i. Check to see that aggregate, mineral filler (if used) and bitumen interlocks are turned on.

j. Check to see that the recorder is reset to zero prior to starting and whenever a mix change occurs. The time, date, aggregate quantities, asphalt quantity and asphalt percentage must be properly recorded.

2. <u>During Production:</u>

a. Check mix temperature at the mixer discharge. This must be within 20°F of the temperature specified.

b. Check to see that during all production start ups and shutdowns the quantity of waste mix is determined and the waste mix is separated from the acceptable mix.

c. Check to see that the holding bin(s) are empty prior to loading and that the correct mix goes into the correct bin on multiple bin systems. See that the bins are emptied at the end of the day's production. Only one mix type shall be placed in any individual bin.

d. Check to see that the plant is producing within the Department approved range. This is listed in the plant automation approval letter.

e. Check to see that recording truck or holding bin scale(s) are operating properly, i.e. no printing occurs if scale is in motion and at least two of the three required weights (gross-net-tare) are printed along with the required time-date information.

f. If a recording truck scale is used and trucks are not tared prior to each loading, see that each truck is weighed empty at least twice a day.

B. SAMPLING AND TESTING

The sampling and testing program outlined below is the minimum amount necessary to assure specification compliance. The Inspector should make every effort to comply with this sampling and testing program. In addition, the testing of belt scales and asphalt meters shall adhere to the following minimum frequencies:

Belt Scale Accuracy

Initial Inspection and Annual Inspection:

Complete series of tests, i.e. three tests at 100% plant capacity and three tests at 50% plant capacity.

Routine 60 Day Scale Inspection:

Abbreviated inspection, i.e. one test at 100% plant capacity and one test at 50% plant capacity.

Suspect Scale Accuracy:

Same as Initial Inspection.

Asphalt Meter Accuracy

Initial Inspection and Annual Inspection:

Complete series of tests, i.e. three tests at 100% plant capacity and three tests at 50% plant capacity.

Routine 60 Day Scale Inspection:

Abbreviated inspection, i.e. one test at 100% plant capacity and one test at 50% capacity.

Suspect Meter Accuracy:

Same as Initial Inspection

1. Plant related tests:

   a. Check the interlocks on the individual aggregate cold bin feeders, mineral filler feeder (if used) and the asphalt delivery system at least once a week.

   b. See that accuracy checks have been performed on the belt scale and asphalt meter at least once every 60 calendar days.

   c. See that a scale and weight recorder print check on either the truck scale or holding bin weigh system has been performed at least once every 60 calendar days.

2. Production related tests:

   a. After the proportions for the individual aggregate feeds have been established for any mix type, test a composite aggregate sample for gradation prior to production. Thereafter, run a composite aggregate gradation at least twice daily.

   b. Determine the moisture content of a composite aggregate sample for the mix being produced at least twice daily.

   c. For each mix produced, determine the moisture content of the final mixture on samples of mix discharged from the holding bin at least once daily.

   d. Determine the bitumen content for each mix produced using the extraction test at least once daily.

   e. Determine stockpile gradation as often as necessary to assure uniformity but not less than once a week.

3. Sample sizes and test procedures for production related tests:

   a. A composite aggregate sample shall be obtained using the automatic sampling device and shall be tested for gradation as follows:

      1. The sample shall be completely dried before sieving except that open base may be sieved without drying.

      2. Samples of open base shall be sieved in the coarse aggregate shaker down to and including the 1/8" sieve.

3. Samples of shim, top, dense binder and dense base shall be sieved in the coarse aggregate shaker down to and including the No. 200 sieve.

Some material will be lost in handling; therefore, if the results on the number 80 and 200 sieves are within 1.0% of the lower Job Mix Formula limit, the material will be considered within the Job Mix Formula limit. If the results on the number 80 and/or 200 sieves are outside these limits, an extraction test must be run immediately and the results from the extraction test shall govern.

b. Minimum sample sizes for testing shall be as follows:

Mix Types	Composite Gradation Test Pounds	Composite Moisture Test Pounds
Open Base	30	15
Dense Base	25	15
Dense Binder	20	10
Top and Shim	15	5

c. The moisture content of the composite aggregate shall be determined by the following equation:

$$\% \text{ Moisture} = \frac{W_{wet} - W_{dry}}{W_{dry}} \times 100\%$$

W wet = Weight of sample containing moisture

W dry = Weight of sample dried to a constant weight.

Note: The composite aggregate moisture content may be calculated from the composite gradation sample as listed in "b" above.

d. Sample sizes for Mixture Extraction Test and Mix Moisture Test:

Mix Types	Minimum Sample Size Grams
Open Base - Dense Base	3000
Dense Binder	2000
Top and Shim	1500

Note: The following procedure applies to base course production. Obtain a mix sample of approximately 25#. Distribute the sample on a flat non-absorptive surface and thoroughly remix the sample with a scoop or shovel. While remixing, work the sample so that it forms a circular flat topped pile of reasonably uniform thickness. With a shovel or scoop divide the sample into equal quarters. Carefully remove one of the quarters and use it for the extraction test. Take care to see that no material is lost from the sample.

It is permissible to use one of the remaining quarters for the mix moisture test.

e. The moisture content of the final mixture shall be determined by the following equation:

$$\% \text{ Moisture} = \frac{W \text{ wet} - W \text{ dry}}{W \text{ dry}} \times 100\%$$

W wet = weight of sample as taken from the mix discharged from the holding bin.

W dry = weight of sample dried in a 350°F oven for 4 hours.

f. For gradation purposes, if specification conforming mineral filler is added separately to any mix, it shall be considered as 100% passing the #200 sieve. It shall be added to the composite aggregate gradation for any mixes requiring it in the proportion that it is added to the mix.

C. INSPECTOR'S COURSES OF ACTION DURING PRODUCTION

1. Aggregate Gradation:

If the results of an Inspector's composite aggregate gradation show that the material is outside the Job Mix Formula limits, notify the Producer immediately to inform him that his material may be out of specifications. Obtain another composite aggregate sample and run a gradation test. If this material is within the Job Mix Formula limits, continue routine testing.

If the second test also shows the gradation to be outside the Job Mix Formula limits, inform the Producer that plant production will not be acceptable until satisfactory corrections are made. Follow the procedure outlined on page 5.12- 6 Section 2a for resuming production. Also see Figure #2 (Page 11).

2. Bitumen Quantity:

The mixture sample on which the bituminous extraction test is run may include retained moisture and, if so, this moisture must be accounted for when determining the bitumen content. This moisture is obtained from the daily mix moisture test (see Section IV Production Inspection B. 2.c., Page 6) and must be deducted from the resultant bitumen quantity to determine an actual bitumen content. If the results of an extraction test are outside the Job Mix Formula limits, immediately check the plant recordation for asphalt quantity. (See Example #1.) If the recordation shows the asphalt quantity also outside the Job Mix Formula limits, notify the Producer that further production is unacceptable. Plant production will not be acceptable until corrections are made.

If the extraction results are outside the Job Mix Formula limits and the plant recordation is within acceptable limits, notify the Producer that his production may be unacceptable. Obtain another mix sample and run an extraction test. If these results are within the Job Mix Formula limits, the material will be considered acceptable and routine production and testing will continue. If the second extraction test is outside the Job Mix Formula limits, notify the Producer that further production will be considered unacceptable until satisfactory corrections are made. See Figure #3.

Example #1 Checking plant recordation for bitumen content:

TIME	AGGREGATE	BITUMEN	% BITUMEN
1526	2603.1	170.46	6.1
1531	2640.3	172.91	6.1
1536	2677.4	175.36	6.1
1541	2714.6	177.81	6.1
	37.2 Ton	2.45 Ton	

$$\text{Bitumen Content} = \frac{2.45}{37.2 + 2.45} = 6.2\% \text{ (for production from 1536 to 1541 hrs.)}$$

Compare the 6.2% from the recordation against the quantity obtained from the extraction.

3. Aggregate Stockpile Uniformity:

If routine stockpile uniformity is out of specifications but the composite aggregate testing is within the Job Mix Formula limits, continue production and notify the Producer that possible aggregate gradation problems can be anticipated.

If two successive routine stockpile tests are out of the gradation limits submitted by the Producer, notify him that the stockpiles are rejected. He may take corrective action by reworking the rejected stockpiles to bring them back into gradation or he may submit new stockpile gradation limits. He may also bring in new material and submit new gradation limits.

4. Moisture Content:

If the moisture content of the mixture exceeds the 1.5% specification maximum, inform the Producer that plant production will not be acceptable until satisfactory corrections are made.

5. Moisture in Aggregates:

a. There shall be no production while it is raining.

b. If the Inspector has reason to believe the composite aggregate moisture content has changed since the last moisture test, he shall take the following action:
(1) If the production has not started, do not allow it to start until a moisture test is conducted and the correct moisture content is input into the system. or
(2) If the plant is producing, stop production until a moisture test is conducted and the correct moisture content is input into the system.

V. DETERMINATION OF ACCEPTABLE PRODUCTION QUANTITY

The acceptable quantity of bituminous concrete mix shall be the total net weight recorded by either recording truck scale or bin scale(s) and dispatched to the project. This material can include a mix moisture up to the specification maximum allowable of 1.5%.

Prior to issuing the quantity acceptance, the Inspector shall compare the dispatched quantity with the plant production recordings and determine that an error not greater than the maximum allowable 2.0% exists between the two. This is done by reducing the different quantities to a common "Total Mix Produced" as shown below:

"TOTAL MIX PRODUCED"

Dispatched + Waste	Production Quantity
Acceptable Quantity	Recorder Aggregate (Dry Weight)
+	+
Plant Waste Mix	Recorder Bitumen
=	+
Total Mix Produced	Average Finish Mix Moisture
	=
	Total Mix Produced

Must be within 2.0%

If more than a 2.0% difference cannot be reconciled, a scale or meter problem is indicated. Therefore checks shall be run on the plant scales and/or meters.

INSPECTOR'S COURSE OF ACTION
FOR
AGGREGATE GRADATION

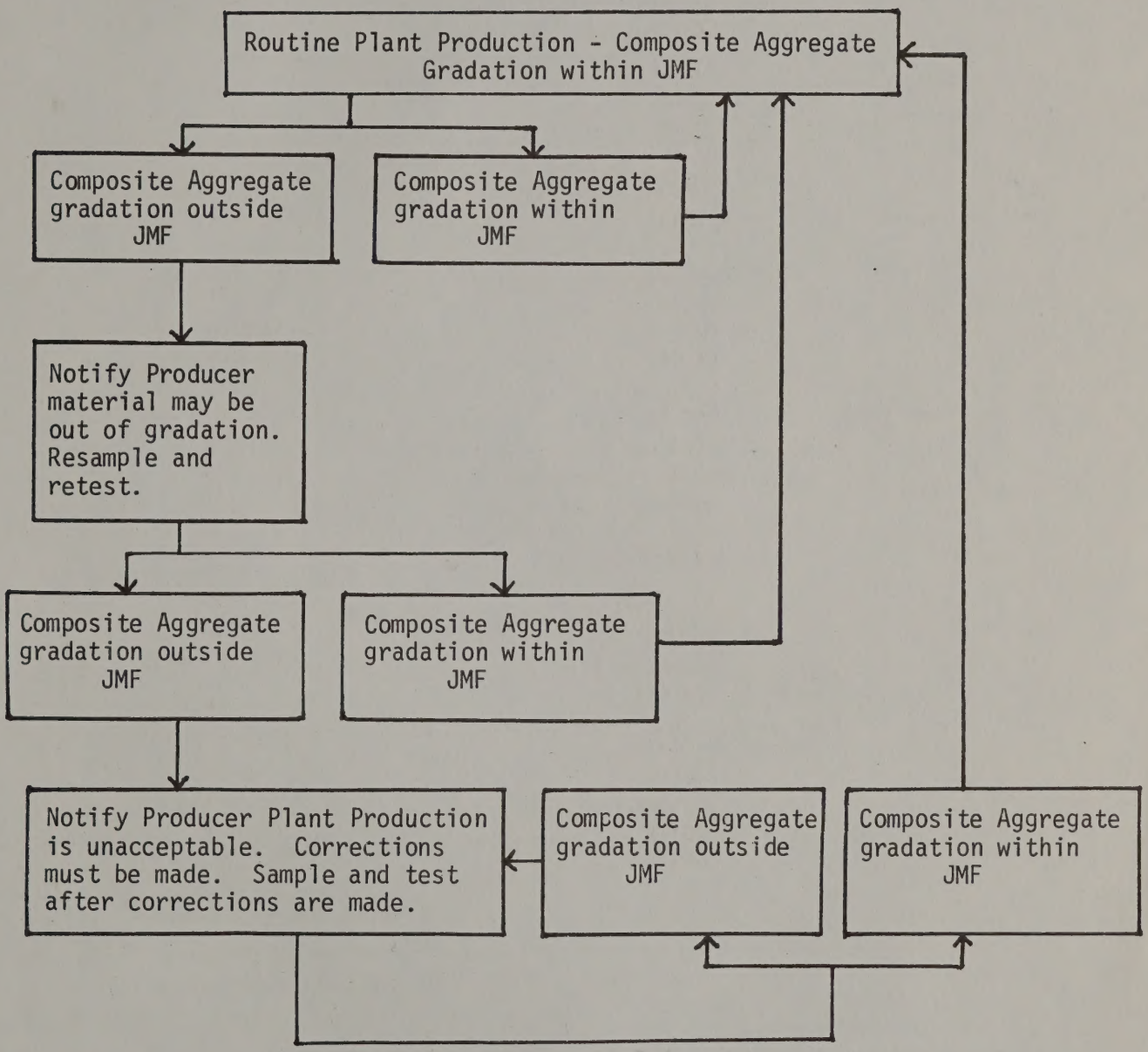

FIGURE #2

INSPECTOR'S COURSE OF ACTION
FOR
BITUMEN QUANTITY

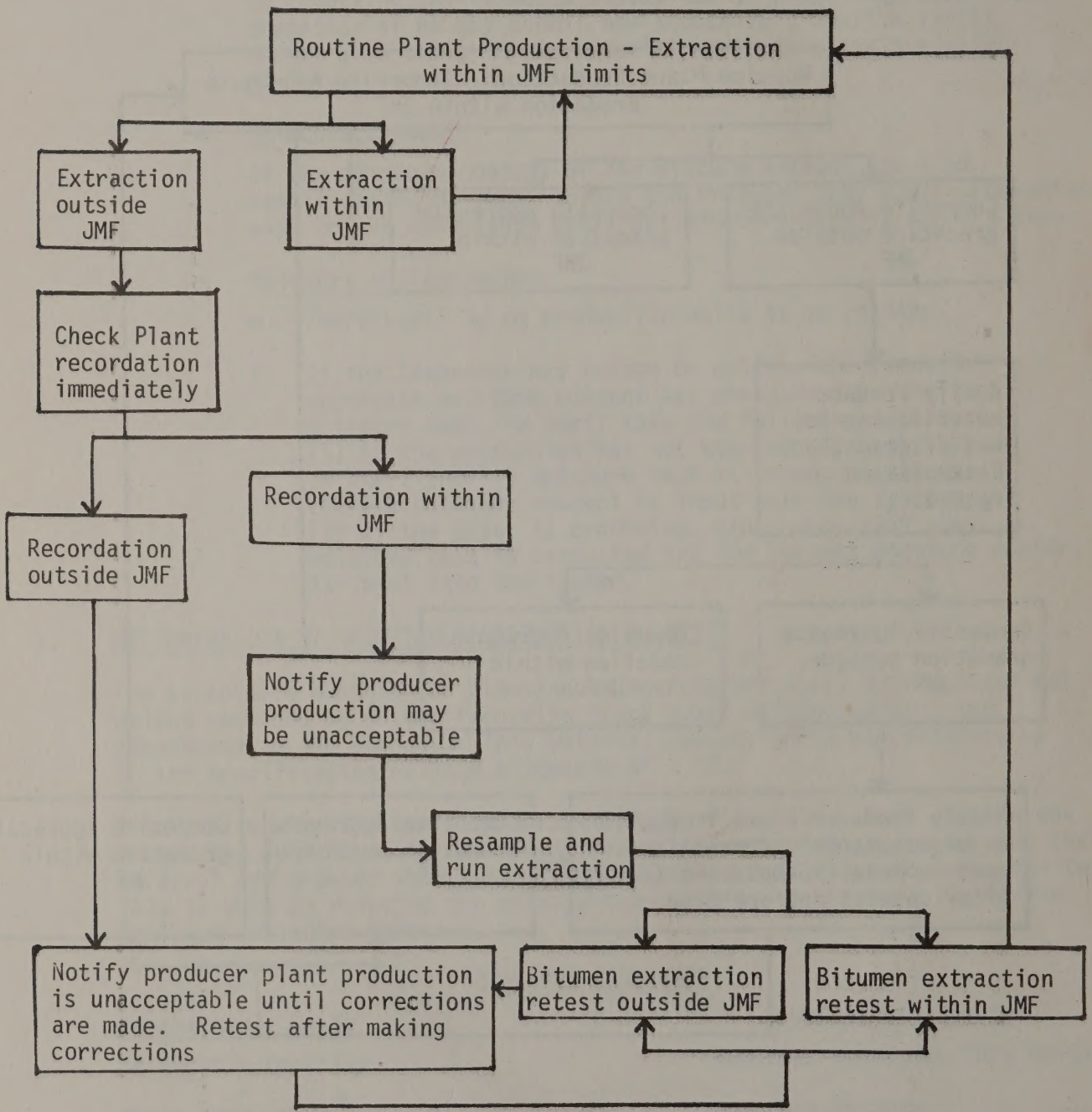

FIGURE #3

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